How does walking influence plantar foot temperature changes in younger and older adults? Implications for people with diabetes

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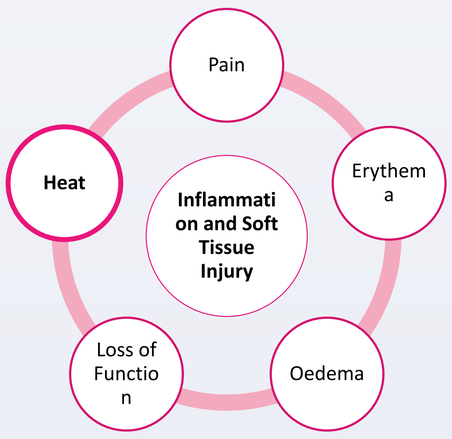
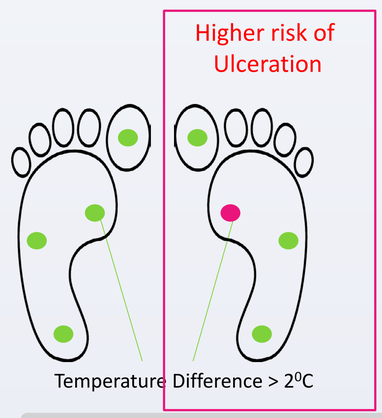
Introduction

Foot temperature monitoring is effective for reducing foot ulcer risk in people with diabetes [1]

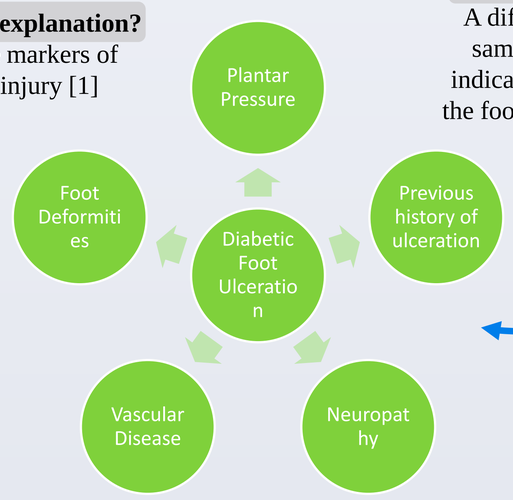


Why – what is the mechanistic explanation?
Heat/Temperature is one of the markers of inflammation and soft tissue injury [1]



What kind of foot temperatures?
A difference in temperatures of the same location in contralateral feet indicates a higher risk of ulceration in the foot with the higher temperature [1]

What is the relationship?

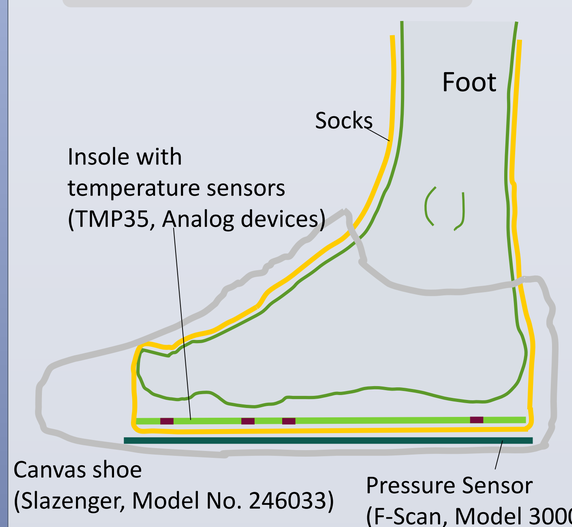


What are the other factors affecting DFU?
Some factors that contribute to diabetic foot ulceration [2]

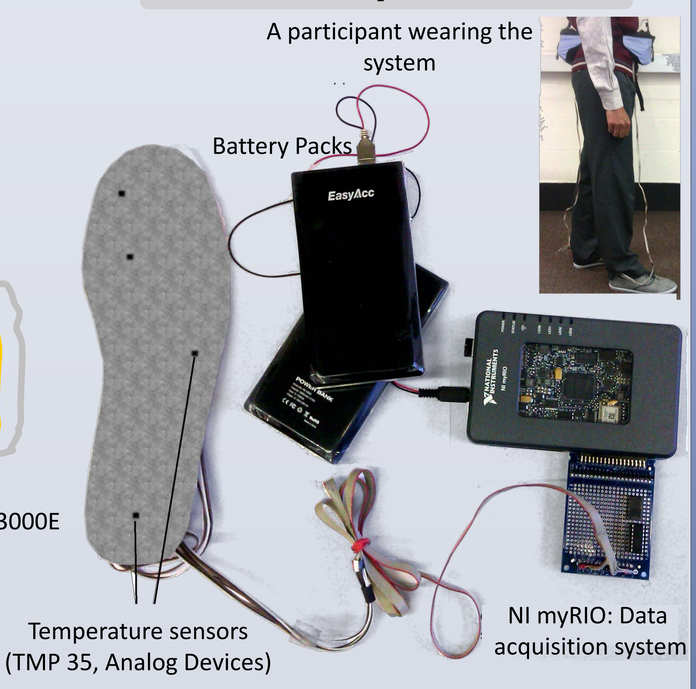
Methods

Foot temperature and pressure data from 18 **healthy** volunteers (ten 30-40 years: 33.4±2.4 years; eight >40 years: 54.1±7.7 years) walking on a treadmill at three different cadences (80, 100, 120 steps/min) recorded

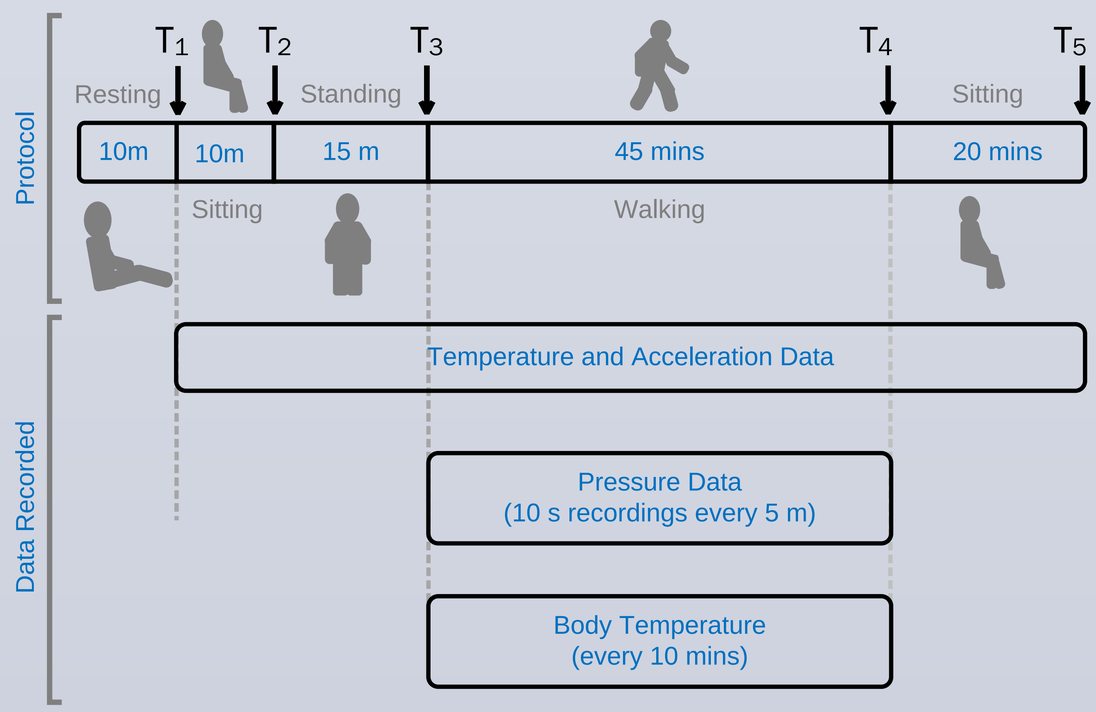
Arrangement of sensors in the foot



Measurement of temperature from the foot



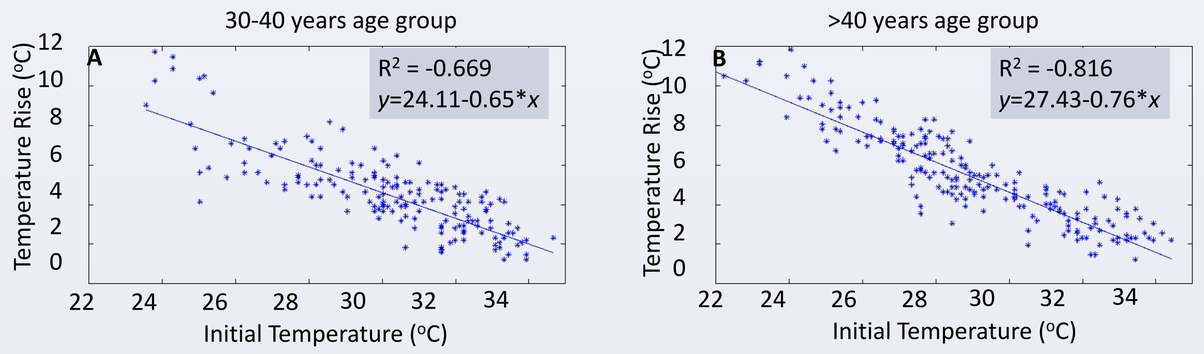
Experimental protocol



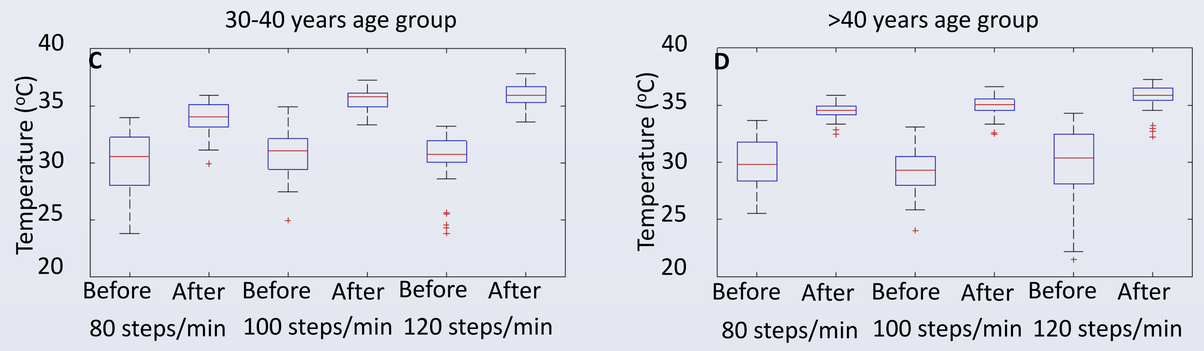
Results

1. The plantar foot temperature increased during walking in both age groups (30-40 years: 4.62±2.00°C, >40 years: 5.49±2.30°C)
2. The temperature rise inversely proportional to initial foot temperature (30-40 years: R^2=-0.669, >40 years: R^2=-0.816)

Plots of the temperature rise of the foot during walking as a function of the initial temperature of the foot: The (inverse) relationship is stronger in the >40 years age group as compared to the 30-40 years age group

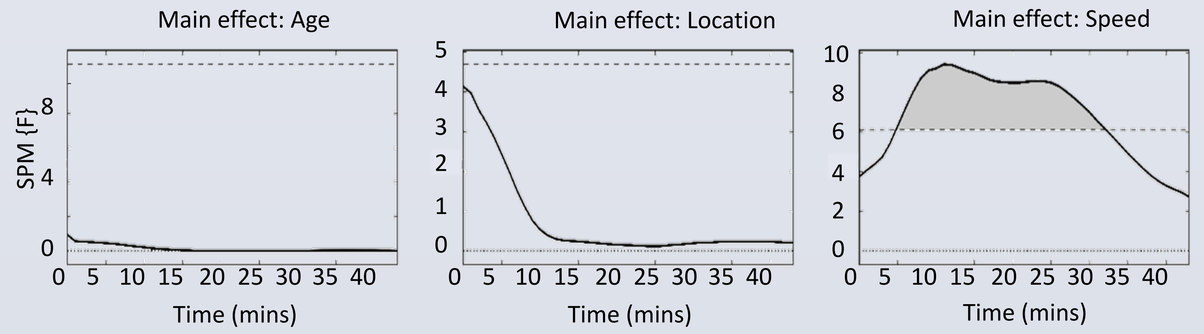


Box plots of the temperatures before and after walking for the three cadences: Note that the variance of the temperatures reduces after walking in each case.



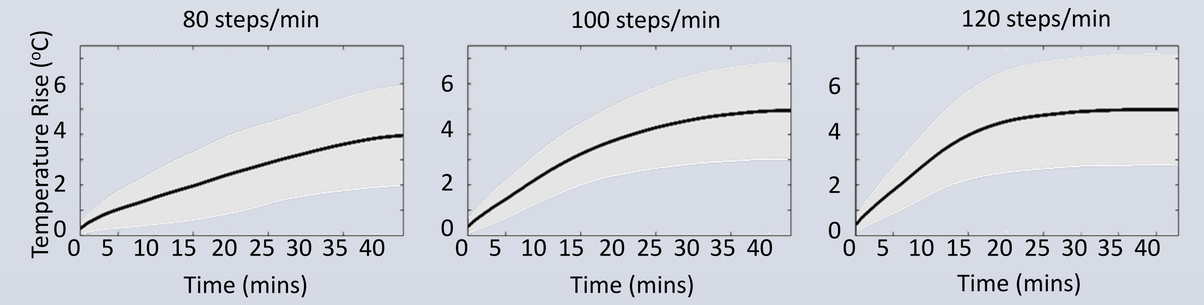
3. Foot temperature changes during walking were not different between the two age groups, or the different foot locations but only depended on the walking cadence.

3D ANOVA (3 way with location and speed as repeated measures) using SPM1d

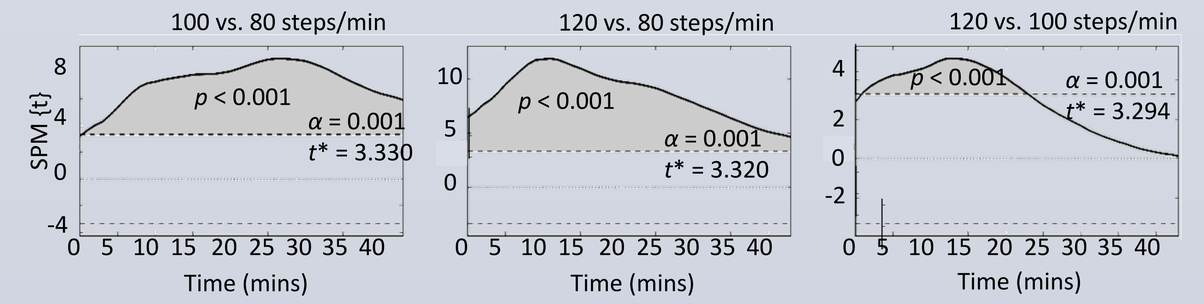


4. Walking cadence affected the rate of change of plantar foot temperature but not the final measured value after 45-minutes walking.

Mean (SD cloud) Temperature Rise: The rate of temperature change differs between walking cadences, but the final recorded temperatures are similar



Paired t-tests: Difference in temperature rise between speeds 100 steps/min and 120 steps/min only until about 23 mins



References

1. V Houghton et al. Foot and Ankle Research. 2013;6(31):1-13
2. LA Lavery et al. Arch Intern Med. 1998; 158:157-62

For details see: NR Prabhav et al. Gait & Posture 2017; 52:272-279